DOCUMENT RESUME

ED 391 027 CE 070 593

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TITLE Case Study on Technical and Vocational Education in Japan. Case Studies on Technical and Vocational Education in Asia and the Pacific.
INSTITUTION Royal Melbourne Inst. of Tech. (Australia).
SPONS AGENCY United Nations Educational, Scientific, and Cultural Organization, Paris (France).
REPORT NO ISBN-1-86272-451-2
PUB DATE 94
NOTE 23p.; For related documents, see CE 070 584-598. Product of the International Project on Technical and Vocational Education (UNEVOC).
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Curriculum Development; *Economic Development; *Educational Change; Educational Development; Educational Improvement; Educational Innovation; Educational Planning; Foreign Countries; Job Training; *Labor Force Development; *Vocational Education
IDENTIFIERS *Japan

ABSTRACT

In the course of Japan's economic progress, remarkable changes have occurred in the structure of industry and employment. Workers are in extremely short supply in such occupations as mining, manufacturing and construction, services, transportation and communication, sales, and professional and technical. On the basis of recommendations of the Central Council for Education, the Monbu-Sho (the Ministry of Education) is now considering specific measures for upper secondary education reform. Three policy measures are to be pursued intensively: the reform of the school and course system, the improvement of the methods and content of education, and a revision of the selection process for admission to upper secondary school. These measures have been implemented in 1993, among them the creation of a new course called the "integrated course" in which students have freedom in course selection and career guidance is offered. The Monbu-Sho is investigating the training of technicians in high schools and aims to develop a vocational education plan for the future. Strategies to innovate technical and vocational education systems to cope with the changing demands of new technologies include the following: improvement in instructional strategies and content of information technology subjects; development of an electromechanical engineering course; and incorporation of managerial and system technologies into vocational courses. Measures are also being taken to promote vocational education and improve teacher quality through staff development. (YLB)

UNEVOC

CASE STUDIES ON TECHNICAL AND VOCATIONAL EDUCATION IN ASIA AND THE PACIFIC

UNESCO

JAPAN

UNEVOC

International Project on Technical and Vocational Education
Projet international pour l'enseignement technique et professionnel

CASE STUDIES ON TECHNICAL AND VOCATIONAL EDUCATION IN ASIA AND THE PACIFIC

Case Study on Technical and Vocational Education in Japan

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First published 1994

ISBN 1 86272 451 2

Published by RMIT for UNESCO

The UNESCO UNEVOC Case Studies on Technical and Vocational Education in Asia and the Pacific project was managed by:
Associated UNEVOC Centre
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Printed by:
Communication Services Unit
Royal Melbourne Institute of Technology
GPO Box 2476V
Melbourne
Victoria
Australia 3001

UNEVOC is the International Project on Technical and Vocational Education which was launched by UNESCO in August 1992.
In the field of technical and vocational education, UNEVOC aims to foster the international exchange of ideas, experience and studies on policy issues; strengthen national research and development capabilities; facilitiate access to data bases and documentation; promote innovations in staff development; and support international cooperative actions.

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1. A REVIEW OF THE CURRENT AND LIKELY FUTURE SITUATION PERTAINING TO TECHNICAL AND FURTHER EDUCATION IN JAPAN

1.1 ECONOMIC CONDITIONS

The economy of Japan continued to grow at a high rate of over 10 per cent per annum throughout the 1980s, led by strong private investment in plant and equipment driven by technological innovations.

After the first oil crisis (1973), a tight monetary policy was introduced in order to cope with inflation and the deficit in the balance of international payments. This caused the economy to contract during 1974, and register a decrease in the economic growth rate for the first time during the postwar period.

In the second half of 1978, just as domestic private demand began to show a strong recovery, the second oil crisis occurred. The rise in import prices in the wake of this crisis, aggravated by the depreciation of the yen, was much higher than after the first oil crisis.

In early 1988, the Japanese economy entered a recovery phase after three years of recession, and there was better business performance and steady economic expansion until June 1985. The downturn in 1985 was mainly attributable to stagnation of exports due to the drastic depreciation of the US dollar. The Japanese economy in 1987 was shifting from recovery to an expansion phase, reflecting stable domestic growth which overcame the decrease in overseas trade due to the stronger yen. In 1988 and 1989, the Japanese economy achieved a domestic demand-led expansion, which was supported by private investment in plant and equipment and private consumption.

After the long and rapid growth since 1987, the Japanese economy experienced a slowdown in expansion around the end of 1980. In the second half of 1991, the economy entered a low economic growth period or 'adjustment phase'. The shift from expansion to adjustment phase resulted in plant and equipment investment and residential construction. Demand for consumer products increased during this period followed by the resultant slowdown.

In addition, the economy has been affected by the 'boom and bust' cycle, after the stock and land prices accelerated well above a level consistent with economic fundamentals, and then crashed. In contrast to past recessions of the 1970s, which were the results of external factors, the present recession resulted from autonomous and endogenous factors, similar to the recession during the high-growth era.

The view points for a desirable direction of the future Japanese economy are three-fold: enhancement of efficiency and growth of firms and the national economy, enhancement of the social welfare of its people in terms of material consumption levels and quality of life and harmonisation with the international economy. In the past, the Japanese economy attached importance to efficiency and growth. In 1991, Japan's GDP was ranked third by the OECD and amounted to $US27106 per capita. Domestically there is a growing recognition that improvement in quality of life has been sacrificed, as working hours are long and the construction of houses and social infrastructures are considered to still be insufficient. The Japanese economy should be in harmony with the economies of other countries. This can be achieved by ensuring transparency and clarifying the rules of its markets.

It is now necessary to shift priorities to the improvement of the quality of life and to carry out structural adjustment for that purpose. As the Japanese economy becomes more domestic-demand oriented in a structural sense, it will contribute to the harmony of the international economy. This should not be considered as harming the efficiency of the economy, but should help create an economy compatible with the goal of improving the quality of life.

1.2 POPULATION

The population of Japan as of 1 October 1991 was 124 million, ranking seventh in the world, and about 2.3 per cent of the world population. The population density in 1991 was 333 persons per square kilometre. Japan is the fourth most densely populated country among those with more than 5 million people.

After the early 1970s the average annual population rate increase declined rapidly. During the years 1985 –91, it was low as 0.41 per cent compared with about 1 per cent during the 1960s and the first half of 1970s.

The future population of Japan is projected to increase moderately, reaching its peak of 130 million in 2011. Thereafter the population will decrease owing primarily to the aged accounting for a high per centage of the population.

1.3 URBAN GROWTH

As a result of the vast increases in the urban population, especially during the latter half of the 1950s, 42.0 per cent of the total population in 1975 was concentrated in the three major metropolitan areas within a radius of 50 kilometres from the city centres of Tokyo, Osaka and Nagoya. The population densities of these three areas are higher than the average: 3,831 person per square kilometre in Tokyo, 2,183 persons in Osaka, and 1,150 persons in Nagoya in 1990.

1.4 EMPLOYMENT

The economy of Japan has steadily grown despite the effects of two oil crises and the strong yen. In the course of that economic progress, it has shown remarkable changes in the structure of industry and employment.

In 1992, the size of the 15 years old and over population was 102.83 million, having increased 0.84 million or 0.8 per cent from the previous year. In this, the labour force numbers 55.78 million, and increased 0.73 million or 1.1 per cent.

In 1992 the number of employed persons increased by 0.87 million, or 1.1 per cent from the previous year, to 64.38 million. Also, the number of non-agricultural employees was 50.86 million in 1992, including the large increase of 1.14 million or 2.3 per cent from the year before.

The proportion of persons employed in primary industry, which had accounted for 12.7 per cent of total employed persons in 1975, reduced to 6.4 per cent in 1992.

The share of employment in Japan's secondary industry indicated a significant increase during the high economic growth period when basic industries had a strong growth period, and reached its peak of 36.6 per cent in 1973. The share of employment in this secondary industry was 34.1 per cent in 1992.

The per centage of persons employed in the tertiary industry, which exceeded half the total employment in 1974, showed a tendency to rise. With the expansion of service industries, the share was up to 59.1 per cent for 1992.

By type of industry, it was noticeable that the number of persons employed in finance, insurance and real estate industries decreased (by 10,000 people) from the previous year for the first time since 1973.

1.5 EDUCATION AND SOCIO-ECONOMIC DEVELOPMENT

In the beginning of the Meiji Era a modern educational system was created, under which an elementary education system offering fundamental education to all the people, and higher education aimed at training leaders, were first developed to push forward the modernisation of the society and the economy.

By the beginning of the 20th Century, enrolment in compulsory education exceeded 80 per cent. As a result of this spread of elementary education, secondary education was promoted, together with the development of vocational education and as the expansion of educational opportunities for women. After World War I, when heavy industry developed further and the Japanese economy reached maturity, the educational system was further expanded and higher education was developed following the spread of secondary education. After World War II, when the Japanese economy entered the stage in which secondary industries developed, tertiary industry expanded and the national income increased. Upper secondary education and higher education took rapid strides under the new education system. From 1965 to 1992, advancement rates to upper education schools increased from 71 per cent to over 95 per cent and advancement rates to institutions of higher education increased from 17 per cent to 39 per cent. The enrolment in institutions of higher education was about 2.8 million in 1992.

1.6 EXPANDED FIELDS OF EMPLOYMENT FOR FEMALE UNIVERSITY AND JUNIOR-COLLEGE GRADATES

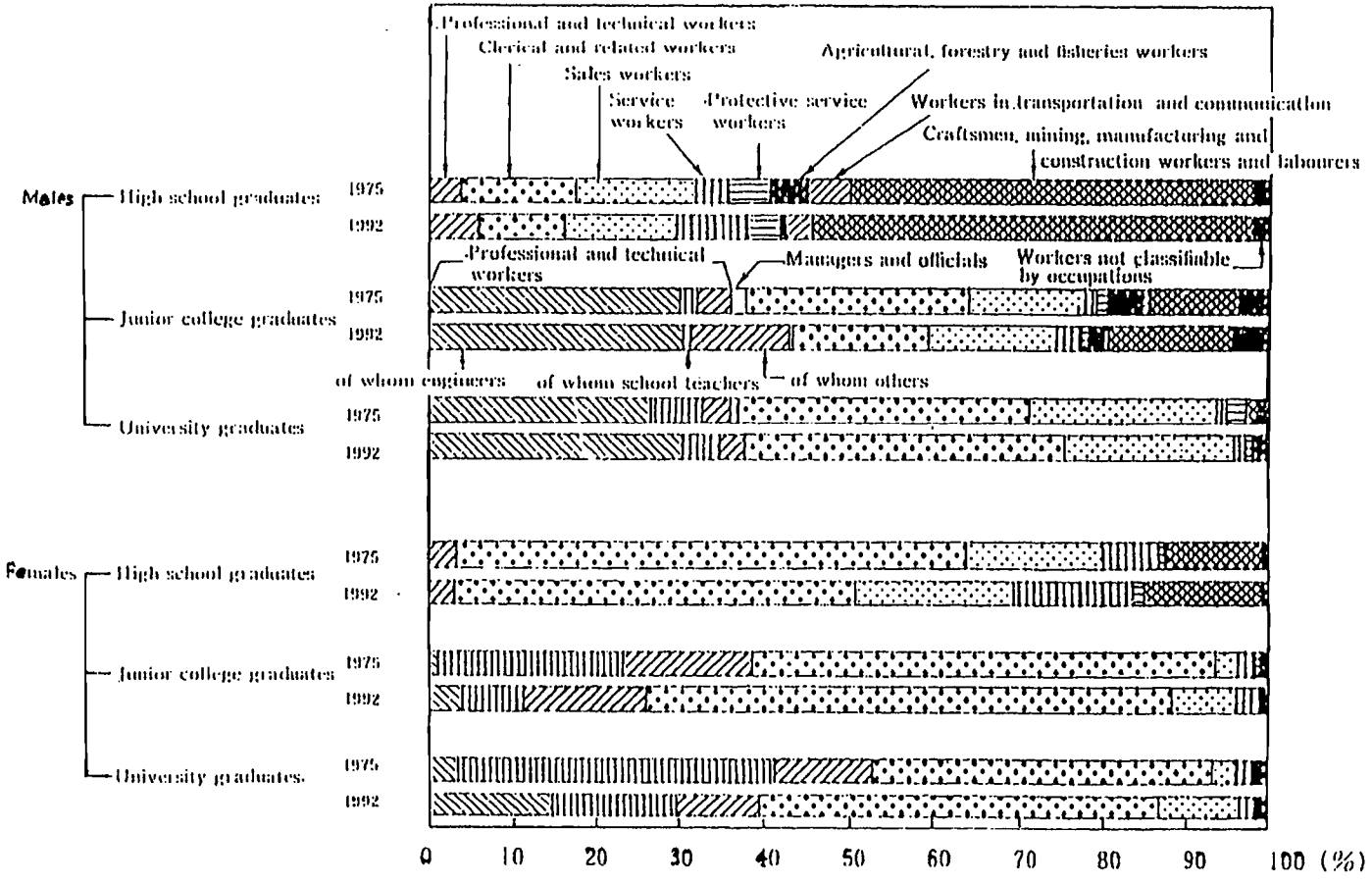
The occupational composition of new school graduates in 1992 shows that no drastic changes were observed in male college and high-school graduates. For female university and junior-college graduates, the per centage of those who took professional and technical jobs declined and that of those engaged in sales jobs rose. Among professional and technical workers, the per centage of school teachers dropped markedly, but that of technical workers, such as information-processing engineers, rose. Thus fields of employment for female university and junior-college graduates expanded gradually from professional and technical work as well as clerical and related work, into sales work. For female high-school leavers, the per centage of those engaged in clerical and related work plummeted from 60.7 per cent. On the other hand, the proportion of those engaged in services jumped from 6.6 per cent to 14.1 per cent. Also, the per centage of craftsmen, mining, manufacturing and construction workers and labourers rose from 10.5 per cent to 14.1 per cent and that of sales workers from 16.3 per cent to 18.5 per cent, thus manifesting a diversified occupational composition.

1.7 STRUCTURAL SHORTAGE OF SKILLED WORKERS

Looking at the vacancy rate by occupation, workers were in extremely short supply in such occupations as mining, manufacturing and construction, the service sector, transport and communication, sales and professional and technical. The per centage of skilled workers in short supply was high especially in the construction sector such as moulding workers and reinforced-concrete workers, and in manufacturing jobs, such as cannery workers and building workers. Lack of skilled workers in these occupations, it is fair to say, is not temporary but structural.

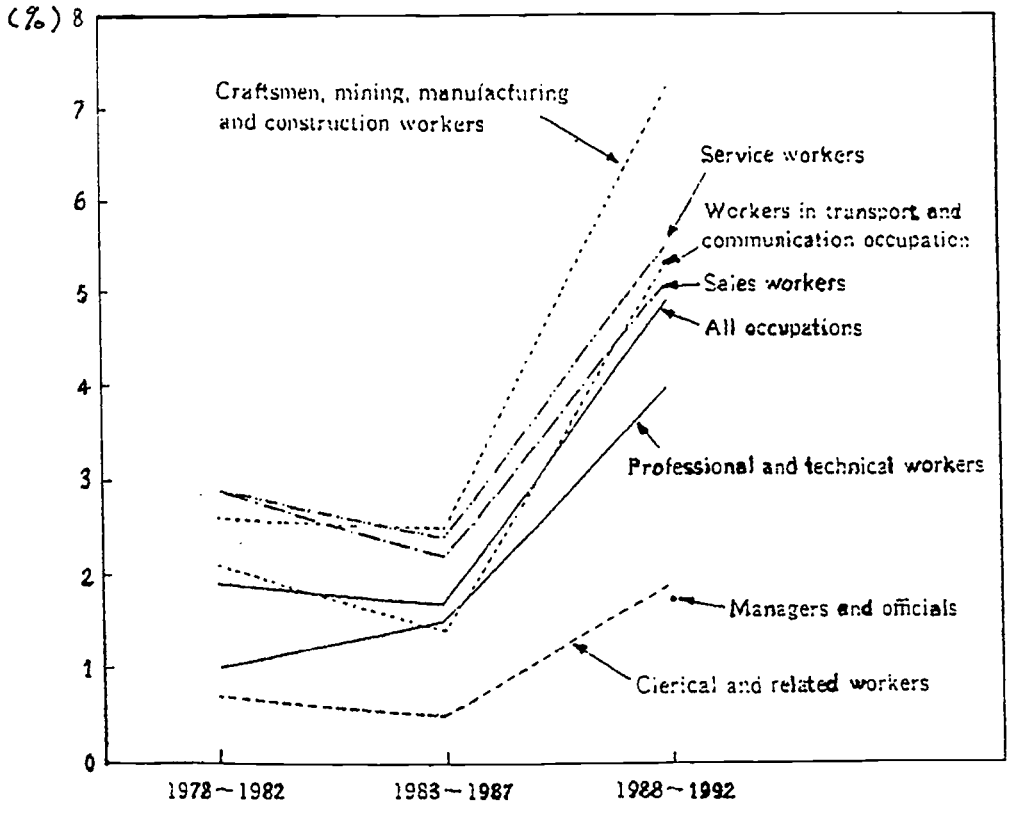
In 1991, both the ratio of new job openings to new applicants and the ratio of job openings to applicants by occupation were down from the level of nine years ago. In the wake of this situation, the mismatch index associated with supply and demand for labour between occupations continued to trend upward in 1992. This was caused by a markedly high ratio of job openings for craftsmen, mining, manufacturing and construction work and professional and technical work, and a surging ratio of job applicants for clerical and related work.

Figure 1
Occupational Composition of New School Graduates who Entered the Work Force by Sex Education



Source: Ministry of Education, *Basic Survey on Schools*

Figure 2
Trends in Vacancy Rate of Occupation



Source : Ministry of Labour, *Survey on Employment Trends*
Note : 1) Vacancy rate

$$= \frac{\text{No. of job openings not yet filled as of end of June}}{\text{No. of workers on payroll as of end of June}} \times 100$$

2) Managers and officials were part of professional and technical workers until 1989.

2. THE EXISTING TECHNICAL AND VOCATIONAL EDUCATION SYSTEM AND AN IMPROVED CURRICULUM ABOUT TECHNICAL AND VOCATIONAL EDUCATION

2.1 THE SCHOOL SYSTEM

The modern system of formal education in Japan was inaugurated in 1872. In 1947, the Fundamental Law of Education and the School Education Law were enacted. Under these laws a formal education system (a 6-3-3-4 system) was established on the basis of the principle of equal educational opportunity.

Upper secondary schools started in 1948 with full-time and part-time courses. In 1961 the correspondence course was added as the third type of upper secondary school courses.

Universities under a new system started in 1949. In 1950 a provisional system of junior colleges started, and a permanent system of this type of college was established through an amendment to the School Education Law in 1964.

Colleges of Technology started in 1962 to provide lower secondary school graduates with a five-year consistent education. Until recently they offered courses in engineering and mercantile marine studies only. Under the amendment made in 1991 to the School Education Law, these colleges are now allowed to provide other courses and to offer short-term advanced courses.

2.2 UPPER SECONDARY EDUCATION

The upper secondary school provides children who have a completed compulsory education with general specialised upper secondary education.

Upper secondary school courses may be broadly classified into two types: general and specialised. The latter may be further classified into: agricultural, industrial, commercial, fishery, home economics, nursing, science–mathematics, English language, and other courses.

Figure 3
Organisation of the Present School System

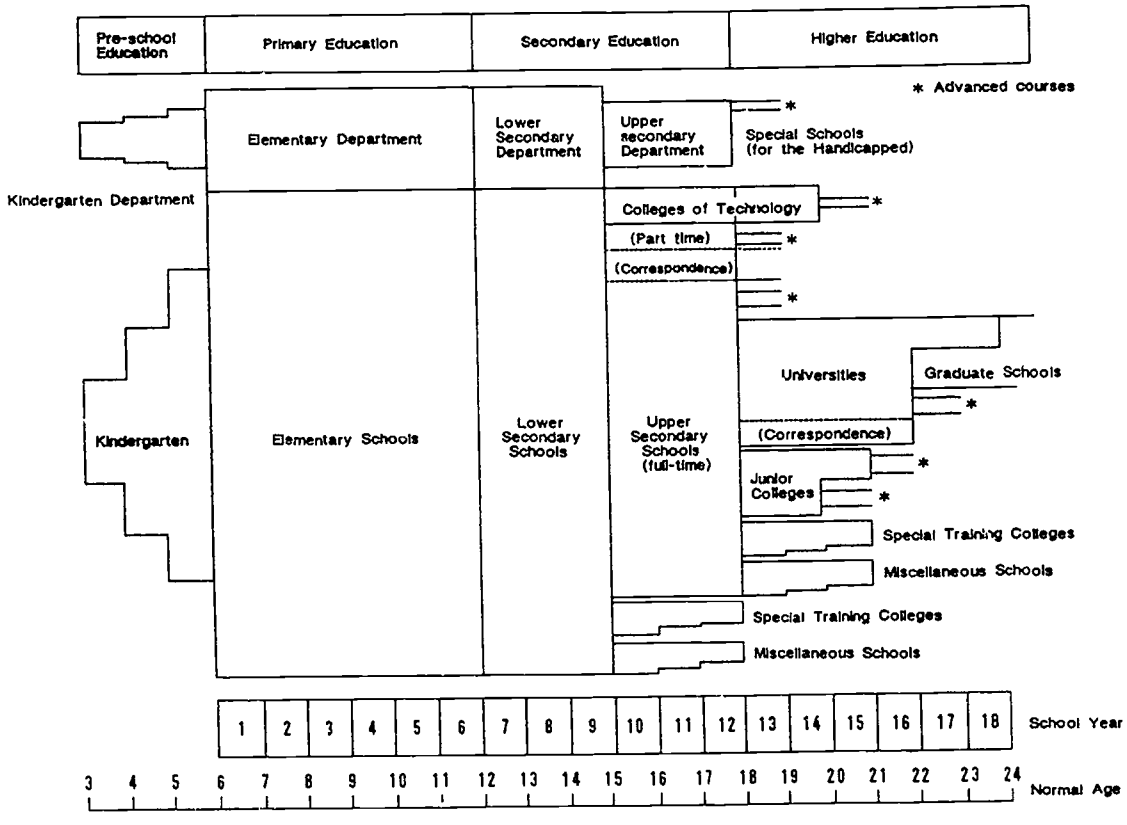
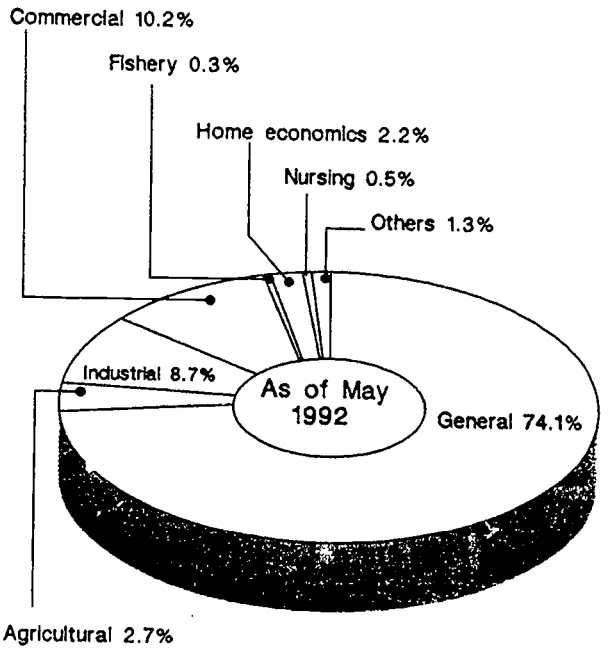


Figure 4
Per centage Distribution of Upper Secondary School Students by Types of Course



Some upper secondary schools offer part-time and correspondence courses to those young workers who wish to receive upper secondary education while employed. In 1988 a new type of school called 'credit-system upper secondary school' was inaugurated. This new type of school is intended to offer people a unique type of part-time or correspondence course so that they may pursue their upper secondary studies at any time in accordance with their own needs.

On the basis of the recommendations offered by the Central Council for Education, the Monbu-Sho is now considering specific measures for upper secondary education reform. This reform is aimed at making upper secondary schools more attractive to students, through: adapting teaching and learning processes at these schools to diverse characteristics of students, changing society, and through providing students with broader choices in learning, thus contributing to the maximum development of student's distinctive personalities.

2.3 THE CURRICULUM

The Monbu-Sho develops and administers national standards for the curriculum for all school levels, from kindergarten to upper secondary, so as to secure an optimum national level of education based on the principle of equal educational opportunity for all.

A Monbu-Sho order entitled 'Enforcement Regulations for the School Education Law' provides for the minimum number of school weeks per year for kindergartens and the names of subjects to be offered in elementary, lower secondary and upper secondary schools.

Broad guidelines for the objectives and content of each school subject are specified in the 'Course of Study' for each of four school levels: kindergarten, elementary, lower secondary and upper secondary. The Course of Study is prepared by the Monbu-Sho on the recommendation of the Curriculum Council, an advisory body to the Minister of Education, and promulgated by the Minister.

Table 1
General Education Subjects in Upper Secondary and the Number of Credits for each Subject

Under the Revised Course of Study				Under the Current Course of Study			
Subject Areas	Subjects	Standard Number of Credits	Subjects required of all students	Subject Areas	Subjects	Standard Number of Credits	Subjects required of all students
Japanese Language	Japanese Language I	4	○	Japanese Language	Japanese Language I	4	○
	Japanese Language II	4			Japanese Language II	4	
	Japanese Language Expression	2			Japanese Language Expression	2	
	Contemporary Japanese Language	4			Contemporary Japanese Language	3	
	Contemporary Japanese Use and Usage	2					
	Classics I	3			Classics	4	
	Classics II	3					
	Appreciation of Classics	2					
Geography and History	World History A	2	One of these two subjects	Social Studies	World History	4	
	World History B	4					
	Japanese History A	2	—		Japanese History	4	
	Japanese History B	4	—				
	Geography A	2	One of these four subjects		Geography	4	
	Geography B	4	—		Contemporary Society	4	○
Civics	Contemporary Society	4	○		Ethics	2	
	Ethics	2	or ○		Politics and Economy	2	
	Politics and Economy	2	or ○				
Mathematics	Mathematics I	4	○		Mathematics I	4	○
	Mathematics II	3			Mathematics II	3	
	Mathematics III	3			Algebra and Geometry	3	
	Mathematics A	2			Basic Analysis	3	
	Mathematics B	2			Differential and Integral Calculus	3	
	Mathematics C	2			Probability and Statistics	3	
Science	Integrated Science	4	—	Science	Science I	4	○
					Science II	2	
	Physics I A	2	—		Physics	4	
	Physics I B	4	—				
	Physics II	2	—				
	Chemistry I A	2	Two subjects from among these five categories of subjects		Chemistry	4	
	Chemistry I B	4	—				
	Chemistry II	2	—				
	Biology I A	2	—		Biology	4	
	Biology I B	4	—				
	Biology II	2	—				
	Earth Science A	2	—		Earth Science	4	
	Earth Science B	4	—				
	Earth Science II	2	—				
Health and Physical Education	Physical Education	7~9	○ *	Health and Physical Education	Physical Education	7~9	○ * *
	Health	2	○		Health	2	○
Art	Music I	2	—	Art	Music I	2	—
	Music II	2	—		Music II	2	
	Music III	2	—		Music III	2	
	Fine Art I	2	—		Fine Art I	2	—
	Fine Art II	2	One of these four subjects		Fine Art II	2	One of these four subjects
	Fine Art III	2	—		Fine Art III	2	—
	Crafts Production I	2	— * * *		Crafts Production I	2	— * * *
	Crafts Production II	2	—		Crafts Production II	2	
	Crafts Production III	2	—		Crafts Production III	2	—
	Calligraphy I	2	—		Calligraphy I	2	
	Calligraphy II	2	—		Calligraphy II	2	
	Calligraphy III	2	—		Calligraphy III	2	
Foreign Language	English I	4		Foreign Language	English I	4	
	English II	4			English II	5	
	Oral Aural Communication A	2					
	Oral Aural Communication B	2			English II A	3	
	Oral Aural Communication C	2			English II B	3	
	Reading	4			English II C	3	
	Writing	4			German		
	German				French		
	French						
Home Economics	General Home Economics	4	—	Home Economics	General Home Economics	4	○ (for girls)
	Home Life Techniques	4	— One of these three subjects				
	General Home Life	4	—				

Number of School Hours per Week for Special Activities

Under the Revised Course of Study		Under the Current Course of Study	
Homeroom Activities and Club Activities	Two school hours or more (One school hour or more for homeroom activities)	Homeroom Activities	One school hour or more
		Club Activities	One school hour or more

Note: For both full-time and part-time courses, thirty-five school hours of lessons per school year are counted as one credit. One school hour lasts 50 minutes.

* 9 credits for students enrolled in full-time general (academic) courses.

** 11 credits for boys enrolled in full-time general (academic) courses.

*** 3 credits for students enrolled in full-time general (academic) courses.

In accordance with the provisions of the School Education Law, Enforcement Regulations for this law, and the Course of Study, individual schools organise their own curriculum, taking into account the circumstances of each school and community and the stage of mental and physical development of children enrolled, as well as their characteristics.

In order to complete an upper secondary school course, a student must earn 80 credits or more. A student enrolled in a specialised course must acquire 30 or more credits in vocational or other specialised subjects.

On 15 March 1989 the Monbu-Sho published revised Courses of Study for four school levels: kindergarten, elementary school, lower secondary and upper secondary school. In revising these Courses of Study, the Monbu-Sho took account of anticipated changes in our society and the resulting changes in the life and attitudes of young people.

It intended to provide children with a sound foundation for their lifelong learning. The basic aim of the revision of the Courses of Study is to keep the 21st Century in view, and ensure the development of people who will be able to cope with the changes in our society, such as internationalisation of different sectors and the spread of information media. The main objectives of the revision are as follows:

1. To attempt to develop young people who have rich and strong hearts and minds, through the whole educational activities of the school, while taking account of children's levels of development, as well as of the characteristics of respective subjects.

2. To place more emphasis on essential knowledge and skills required of every citizen of our country, and to enhance educational programs that would enable each child to give full play to his or her individuality. A consistency in the curriculum for each subject area should be secured among different school levels from kindergarten to upper secondary school.

3. To attach more importance to the nurture of children's capacity to cope positively with changes in society, as well as to the provision of a sound base for fostering children's creativity. Children's willingness to learn 'how-to-learn' is also to be stimulated.

4. To put more value on developing in children an attitude of respecting Japanese culture and traditions, as well as an increased understanding of the cultures and histories of other countries in the world. Thus children should be helped to develop the qualities required of a Japanese living in the international community.

The revised Course of Study was put into effect in 1990 for kindergartens and in 1992 for all grades of elementary school. The revised Course of Study for lower secondary schools was put into practice in 1993 for all grades of lower secondary school. The revised Course of Study for upper secondary schools will become effective progressively from 1994 (1994 for the 10th grade, 1995 for the 11th grade and 1996 for the 12th grade).

2.4 VOCATIONAL EDUCATION CURRICULUM OF SPECIALISED COURSES OF UPPER SECONDARY SCHOOLS

All upper secondary schools are to follow the Course of Study for upper secondary schools, provided by the Minister of Education, Science and Culture in accordance with the School Education Law. It specifies the subjects both in general and specialised courses, as well as the objectives and the level of content in each subject.

In order to complete an upper secondary school course, a student must earn 80 credits (one credit consists of 35 class hours) as required by each school. In the case of the students enrolled in specialised courses, they must acquire at least 30 credits in specialised subjects adding to the compulsory subjects required of all upper secondary school students without regard to the type of the course. Examples of the compulsory subjects are: Japanese language, mathematics, and physical education.

All specialised courses emphasise the importance of experiments and practical training. More than one-half of the total class hours of the subjects related to vocational education are allocated to such experiments and practical training. They are conducted both inside and outside the classroom. For example, training voyages for a few months (Fishery), clinical practice in hospitals (Nursing), sales practice in department stores (Business).

The Course of Study was revised in March 1989, and will be implemented in 1994. One important change in the revision was the improvement of the content of specialised subjects to cope with the ongoing technical development and the changes in the industrial structure and employment system. More concretely, it was aimed to improve the education system to cope with the recent changes in the society, such as the growing importance of information processing in each industrial area, the development of biotechnology, the innovations in electronics, the trend to sell more services than goods, and the globalisation of Japanese companies. In addition to the improvement of the above areas, a new subject was introduced, 'Project Study'. Project Study was added as a compulsory subject for all students enrolled in the specialised courses of upper secondary schools, except nursing. A few examples of the content of the Project Study are: manufacturing of electric automobiles, researching traditional craft works, and practical training at the automobile manufacturing factory.

Moreover, Home Economics became compulsory for both boys and girls. The aim of this was to give both future husbands and wives the opportunity to learn basic knowledge and skills to create a happy home life, coping with changing social environments, especially the trends toward the nuclear family and the ageing society.

The following subjects are some examples offered to the students in specialised courses under the revised Course of Study.

- Home Economics: Home Information Processing, Consumption Economics, Home Management, General Home Economics, Public Health and Living Technology.
- Agriculture: Agricultural Information Processing, Foundation of Biotechnology, Agricultural Economics, Agricultural Accounting, Food Stuff Distribution, Food Processing, Horticulture and Agricultural Machinery.
- Industry: Electronic Technology, Environmental Technology, Environmental Conservation, Industrial Management Technology, Textile Technology, Industrial English, Application of Computers, Applied Electronic Machinery, Foundation of Information Technology, Programming Technology, Hardware Technology, Software Technology and Application of Computers.
- Business: Distribution Economics, Information Processing, Marketing Management, Business in English, Programming, International Economics and Information Management.
- Fisheries: Fishery Information Processing, Fishery Economics, Fishery Technology, Electric Engineering, Communication Technology, Telecommunication Theory, Fishery Food Distribution, and Fishery Information Technology.
- Nursing: Nursing Information Processing, Nursing of Adult Patients and Nursing of Mother and Child.

3. NATIONAL POLICIES AND INNOVATIVE MEASURES TO PROMOTE THE FURTHER DEVELOPMENT OF TECHNICAL AND VOCATIONAL EDUCATION

3.1 REFORM OF UPPER SECONDARY EDUCATION

In April 1991, the Central Council for Education issued recommendations on the diversification and the increased flexibility of upper secondary education. The policy measures to be pursued intensively are the reform of the school and course system, the improvement of the methods and content of education and a revision of the selection process for admission to upper secondary school. These measures have been implemented in April 1993, among them is the creation of a new course called the 'Integrated Course'.

3.2 THE 'INTEGRATED COURSE'

Courses in upper secondary school were divided into two: the course devoted mainly to general education (general course) and the one mainly devoted to specialised education, with the latter further subdivided into the vocational and technical courses dealing with each industry (agriculture, business, fishery, nursing-related courses, etc.), and the other courses such as music-related courses, fine arts related courses and physical education-related courses.

Besides these two courses the 'Integrated Course' has been created as a third option. In this 'Integrated Course' students can enjoy optimum freedom in the selection of subjects. Among the 80 credits students have to acquire before graduation, 35 credits are compulsory in the subjects of Japanese Language, Social Science, Mathematics, Industrial Society and Human Beings and Information Education. A work experience project, in conjunction with a Japanese company, is also compulsory. The other subjects are completely free for students to select. Students select subjects which they want, and plan their own upper secondary education. By enjoying this optimum freedom and active learning, students are expected to cultivate the ability to learn independently, which is essential to work in a rapidly changing society where new knowledge and skills become quickly out-of-date.

The other main feature of the 'Integrated Course' is career guidance. The whole education of the 'Integrated Course' is organised for career guidance. The above mentioned Industrial Society and Human Being is, in some sense, an orientation program for a career guidance. In the 'Integrated Course' emphasis is put on the cultivation of abilities and aptitudes of students for a career. Therefore, schools which have the 'Integrated Course' are obliged to open a certain number of vocational subjects so that students can deepen their understanding of a career by taking those vocational subjects. Through the three–year course, students are brought up to find which occupation they would like to pursue in the future.

It is predicted that the 'Integrated Course' will change the attitude of Japanese upper secondary school students toward a career and is an example of the convergence of vocational and general education.

3.3 THE TRAINING OF TECHNICIANS

The Monbu-Sho is investigating the training of technicians within high schools and aims to develop a vocational education plan for the future.

One major problem facing the promotion of technician training in Japan is the attitude of young people to work in industry, especially the manufacturing sector, which they see as 'dangerous, dirty and hard'. The Monbu-Sho aims to promote the training of technicians in Japan and encourage young people to acquire vocational qualifications to support the increasing demand for qualified persons to operate and maintain high technology equipment and facilities.

With the aim of enhancing the skills of Tech/Vocational High School graduates, a partnership between academic institutions, industry and vocational high schools has been established to provide equipment to the schools and improve the delivery and content of the curriculum.

4. STRATEGIES TO INNOVATE TVE SYSTEMS TO COPE WITH THE CHANGING DEMANDS OF NEW TECHNOLOGIES IN VOCATIONAL COURSES

4.1 THE INFORMATION REVOLUTION IN JAPAN

Japan is predicted to move into the advanced level of the information society in the future, bolstered by progress related to technological innovations in the information processing and telecommunication sectors. Rapid increases in the use of information technology is illustrated by the spread of the production environment information system in agriculture, sales information management in the distribution business sector, the seat reservation service in the transport business sector and computer-aided diagnosis systems in the medical sector. The need is for improvement in the instructional strategies and content of the information technology subjects in both the business and industry courses to help students learn the basic knowledge and skills concerning the effective use of information technology systems in the various sectors.

4.2 THE FACTORY AUTOMATION TREND OF THE CHANGING WORKPLACE

In undertaking vocational education to adapt to the social and economic changes in Japan, it may be more effective on some occasions to develop new courses rather than merely improving and enlarging the content in the existing courses.

With reference to the above, the new Electro-Mechanical Engineering (Mechatronics) Course aims to have students learn the mechanical and electronics technology in an integrated way.

Based on recent developments and the popularisation of numerical control machinery the processing and assembling industry sectors are undergoing change, with rapid automation and systematising trends under way through the integration of machinery. The Electro-Mechanical Course was developed to train specialists who understand both of these two technologies and are capable of running and managing advanced production systems.

4.3 THE SOCIAL DEMAND FOR VARIED TYPES OF SERVICES

In business courses, which have until now been focused chiefly on the merchandise transaction and electrical jobs, it is necessary to give increased attention to service business courses which allow students to acquire the knowledge and skill related to management and administration of these industries.

4.4 INCORPORATING THE NEW TECHNOLOGIES IN VOCATIONAL COURSES

The introduction of managerial technology and system technologies in industry will have to be incorporated into vocational courses.

With biotechnology steadily advancing as a new technology in agriculture and fishery sectors, it will be necessary to introduce biotechnology concepts and practice into these courses.

In the courses related to such industries as metals and ceramics, consideration should be given to the need to give instruction in new materials, including the new metal and inorganic materials.

5. MEASURES FOR THE PROMOTION OF VOCATIONAL EDUCATION

Various methods are being taken to promote vocational education at the upper secondary level. Two major ones are:

1. National government subsidy, under terms of Vocational Education Promotion Law.
   The national government is obligated by this law to strive for the promotion of vocational education and to encourage local governments to facilitate vocational education by such means as subsidies.

2. Training of upper secondary school teachers.
   The teachers are trained to keep up with the changes of new technologies such as information processing, biotechnology and electronics.

5.1 COURSE AND EQUIPMENT DEVELOPMENT

The Sectional Meeting for Electronics, an advisory body to the Ministry of Education reported the need for, and course development of, an electro-mechanical course within the field of industrial education. In October 1983 the 'Mechatronics Course' was developed.

The Mechatronics course integrates the electronic-related and the machinery-related courses.

The Curriculum for the Mechatronics course is as follows:

- Equipment to be used for practice in mechatronics course are large systems. For example computers, control system, numerical control (NC) lathe, machining centre (MC) combined drilling machine and milling machine and flexible manufacturing system (FMS).

- Large equipment systems are developed in each factory, but small equipment for instructional materials is developed by teachers in each technical high school and university.

- Equipment is made by teachers. For example, many kinds of computer-controlled training systems, simulators and experimental equipment for basic theory.

Table 2
Example of curriculum for Mechatronics Course

Subject area	Subject	Grade			
		1	2	3	Total
Japanese Language	Japanese Language I	4			4
	Japanese Language II				
Social Studies	Contemporary Society	2	2		4
	Japanese History				
	World History				
	Geography				
Mathematics	Mathematics I	4			4
	Basic Analysis		②	②	④
	Defferentiation & Integration				
Science	Science I	4			4
	Physics		②	②	④
	Chemistry				
Health & Physical Education	Physical Education	2	2	3	7
	Health	1	1		2
Art	Music I				
	Fine Art I	2			2
	Calligraphy I				
	Handicrafts I				
English	English I	2	2		4
	English II				
Small Total		21	9	5	
Industry	Industrial English		1	2	3
	Fundamentals of Industry	3			3
	Practice		6	6	12
	Drawing	2	3	3	8
	Industrial Mathematics	2	2		4
	Machine Engineering Work	2	2	1	5
	Machine Design		4	3	7
	Measurement & Control			4	4
	Fundamentals of Electricity	2	5		7
	Electronics Technology I			4	4
	Information Technology I			2	2
	Systems Technology			2	2

The number of credit with a circle shows a selective subject.

6. MEASURES TO IMPROVE THE QUALITY OF TEACHERS AND INSTRUCTORS

6.1 STAFF DEVELOPMENT

In Japan, staff–related teaching material about new technology is developed by an in-service training program of teachers managed by the Ministry of Education (MOE) or the Board of Education in each prefecture.

In-service training programs are conducted at the Institute of Educational Research and in-service training in universities and companies.

The following is the example of staff development for Data Processing Education in Japan.

Data Processing Education was started from the 'Proposal on the Promotion of Data Processing Education in High School', December 1969 reported by the Council for Science Education and Industrial Education. At the same time, the in-service teacher training program was started for the leading teachers in each prefecture by the MOE.

This 'Inservice Training of Teachers for Information Technology' program was conducted over a 40-day period during the summer school break.

The program was an introduction to computer technology and covered topics such as hardware, software, operating systems, algorithms, on-line systems, compiler, computer graphics, and practice of programming using FORTRAN or COBOL language and system design.